

CMC-CAT

Complex Materials Consortium CAT

Overview

The Complex Materials Consortium CAT (CMC-CAT) was organized by individuals who share a common research interest in complex materials and a strong dedication to the use of the unique properties of synchrotron radiation to structurally and functionally characterize them. This organization was subsequently formalized into a consortium containing the following institutional members: Exxon Research and Engineering Company, University of Pennsylvania, Brookhaven National Laboratory, Princeton University, University of California at Santa Barbara, Los Alamos National Laboratory, Oak Ridge National Laboratory, and the University of Tennessee.

Research Focus

Complex materials, broadly defined, are materials that possess unique and novel properties by virtue of the complexity of their molecules and/or the complexity of interaction between their molecules. These materials include polymers, surfactants, liquid crystals, biomaterials, membranes, and thin molecular films of hydrocarbons on solid or liquid surfaces. They also include novel synthetic materials such as fullerenes, fibers, polymer composites, oxides, and zeolites. A basic understanding of the molecular structure, morphology, and molecular dynamics of such materials, particularly under non-equilibrium conditions or at interfaces, is essential for the development and optimization of novel materials and processes for industry. It is equally important for obtaining a complete theoretical description of the equilibrium and non-equilibrium behavior of complex, multicomponent systems.

At the APS, CMC-CAT uses several experimental techniques to study complex materials on a variety of length and time scales. The techniques include small-angle and wide-angle x-ray scattering, liquid surface spectrometry, x-ray surface scattering, x-ray spectroscopy, magnetic scattering, inelastic scattering, and x-ray microtomography and imaging. The studies depend on novel technical developments such as ultrafast-high-resolution two-dimensional imaging detectors, high-speed data inversion and image-processing algorithms, and novel x-ray microfocusing devices. Using such techniques, CMC-CAT researchers study phenomena such as the dynamic response of polymers, membranes, fibers, and fluids to applied stresses; the kinetics of phase separation in mixed systems; the formation of pitting, corrosion, and protective layers on metals in electrolytic solutions; the formation of novel surface structures on catalysts undergoing reactions; the formation of cracks and voids in composite materials; the properties of transition metal oxides; and the flow of fluids through microporous solids such as oil-bearing rocks or sand.

CAT contacts:	Doon Gibbs, <i>CAT Director</i>	tel 631.344.4608	doon@solids.phy.bnl.gov
	Thomas Gog, <i>Assoc. CAT Director</i>	tel 630.252.0320	gog@anl.gov
	Chitra Venkataraman, <i>Beamline Scientist</i>	tel 630.252.0327	chitra@anl.gov
Beamline contacts:	Thomas Gog, <i>(9-BM & -ID)</i>	tel 630.252.0320	gog@anl.gov
	Chitra Venkataraman, <i>(9-BM & -ID)</i>	tel 630.252.0327	chitra@anl.gov